



March 13, 2009

**Certified Mail No. 7007 0710 0001 2887 9504**  
**Return Receipt Requested**

Richard Goodyear, P.E.  
Permit Programs Manager  
Air Quality Bureau  
New Mexico Environment Department  
1301 Siler Road, Building B  
Santa Fe, NM 87507

**Re: Permit No. 325-M-9, Rev.19 - Technical Permit Revision**

Dear Mr. Goodyear,

As noted in our February 12, 2009 Technical Permit Revision submittal for the Boiler emission factors, Intel is submitting this additional request to revise Permit No. 325-M-9, Rev. 19 (Permit). This request includes revisions to the emission factors (EFs) for NOx and CO in Table 1 for the thermal oxidizers (RTO), revisions to the emission factors for hazardous air pollutants (HAP) and volatile organic compounds (VOCs) in Tables 3 and Z, addition of emission factors for the ammonia treatment system and revisions to the language in the permit regarding the submittal date for the boiler emission factors.

#### Emission Factors

Pursuant to Condition 1.G of the Permit, Intel submits the following proposed technical permit revision to change the emission factors (EFs) for NOx and CO in Table 1 for the thermal oxidizers (RTO) and to change the factors for hazardous air pollutants (HAP) and volatile organic compounds (VOCs) in Tables 3 and Z. Table 1 of the Permit contains the EFs used to calculate Intel's twelve-month rolling total NOx, CO and VOC emissions from the combustion of natural gas; Tables 3 and Z contain the HAP and VOC EFs used to calculate Intel's twelve-month rolling total HAP and VOC emissions.

#### *RTO NOx & CO EFs*

Intel is requesting that the emission factors for NOx and CO for the Durr RTOs be updated using the hourly maximum emission rates from the past two years of FTIR testing and average natural gas consumption rate from the past two years. Munters RTO emissions will continue to be based on AP-42 emission factors until the units have been tested and site specific emission factors can be developed. Enclosure 1 contains the summary operational and testing data used to calculate the proposed emission factors for the Durr RTOs and AP-42 emissions factors for the Munters RTOs.

#### *Ammonia Treatment System*

Intel is requesting that a combination of manufacturer's information and AP-42 emission factors be used combustion pollutants from the ammonia treatment system. Intel is requesting the use of manufacture information for NOx and CO and the use of AP-42 emissions factors for VOC, SO2 and TSP/PM10 that are located in AP 42, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Table 1.4 - (<http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf>). Emission factors will be as follows:

<b>Pollutant</b>	<b>Emission Factor</b>
NOx	0.06 lb/MMBtu
CO	0.3 lb/MMBtu
VOC	5.5 lb/10 <sup>6</sup> scf
SO2	0.6 lb/10 <sup>6</sup> scf
TSP/PM10	7.6 lb/10 <sup>6</sup> scf

Emission factors for ammonia and NOx from the use of LCP Oxide Etch (source of ammonia) are included in the Table 3, Enclosure 2.

*HAP and VOC EFs*

The proposed revision reflects the following changes to the emission factors:

- 1) Inclusion of the process changes at the site that already have been implemented and those that will be implemented in the future.
- 2) Inclusion of several chemicals for which chemical-specific factors are not specified in the permit. These chemicals currently have a default emission factor of 1.0 and are either chemicals that were not previously used at Intel, or chemicals that have been used at Intel, but did not have previously established emission factors.


Enclosure 2 provides the detail for changes to the emission factors.

*Condition 2.C.ii.f*

Intel is requesting that the submittal date listed in Condition 2.c.ii.f be extended until March 15. This change allows more time to complete the updates to the VOC and HAP EFs that Intel has been submitting annually since 2005. This change will still allow the 1<sup>st</sup> quarter emissions for that year to be calculated using the updated emission factors.

Pursuant to 20.2.72.219.B.6 NMAC, Intel will provide notice by certified mail to all municipalities, Indian tribes, and counties within a ten-mile radius of the site and publish as required. Copies will be sent separately. If you have any questions or need additional information, please contact Sarah Chavez at (505)794-4917.

Sincerely,



Frank Gallegos  
NM Site Environmental, Health & Safety Manager

Enclosure 1: RTO Emission Factor Explanation

Enclosure 2: HAPs and VOC Emission Factor Explanation with Updated Emission Factors


CERTIFICATION

I, Frank E. Gallegos, Intel Site EHS Manager, hereby certify that the information and data submitted in this application are true and as accurate as possible, to the best of my knowledge and professional expertise and experience.

  
Frank E. Gallegos

STATE OF NEW MEXICO       )  
  )ss.  
COUNTY OF SANDOVAL       )

Subscribed and sworn before me on this 13 day of March, 2008 by Frank E. Gallegos.

<sup>SKB</sup>  


[My commission expires: MAY 22, 2012]



## Enclosure 1

### RTO Emission Factor Explanation

## Enclosure 1: RTO Emission Factor Explanation

### EF Explanation

#### Durr RTOs

The emission factors for NO<sub>x</sub> and CO for the RTOs are determined using the standard methodology in the permit for calculating emission factors. The emission factors for NO<sub>x</sub> and CO are based on operational and testing data using the hourly maximum emission rates from the past two years of FTIR testing conducted during permit required compliance sampling and average natural gas consumption rate from the past two years, as reported to NMED in quarterly emissions reports. This approach is similar to the approach outlined in the permit to update the emission factors for the 1250 HP Boilers and will take into account any variability in the systems that may occur. The emission factor will be calculated as follows:

$$\frac{\text{Maximum 2 Year Testing Data (lb/hr)}}{\text{2 Year Average Operational Firing Rate data (MMBtu/hr)}} = \text{Emission Factor (lb/MMBtu)}$$

Below are the summary operational and testing data used to calculate the updated emission factors.

#### Munters RTOs

Intel is requesting that AP-42 emission factors for NO<sub>x</sub> and CO continue to be used for the Munters RTO until the units have been tested and site specific emission factors can be developed. Intel is requesting the use of AP-42 emissions factors that are located in AP 42, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Table 1.4- (<http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf>). Emission factors will be as follows:

Pollutant	Emission Factor (lb/10 <sup>6</sup> scf)
NO <sub>x</sub>	100
CO	84

Enclosure 1: RTO Emission Factor Explanation

Operational and Testing Data for Durr Thermal Oxidizers

	2007 Average Firing Rate (MMBtu/hr)	2008 Average Firing Rate (MMBtu/hr)	2 Year Average Firing Rate (MMBtu/hr)	2 Year Maximum NOx Emissions (lb/hr)	2 Year Maximum CO Emissions (lb/hr)	NOx Emission Factor (lb/MMBtu)	CO Emission Factor (lb/MMBtu)
2.5 MMBtu/hr Thermal Oxidizer (F11x Fab and F11x Bridge)	1.48	1.45	1.46	0.731	0.181	0.50	0.12





# Enclosure 1: RTO Emission Factor Explanation

<b>Thermal Oxidizer</b>	<b>Quarter</b>	<b>Date Tested</b>	<b>NOx (lb/hr)</b>	<b>CO (lb/hr)</b>
Fab 11X-B	2007 Q1	2/27/2007	0.148	ND
Fab 11X-B	2007 Q1	3/6/2007	PM	PM
Fab 11X-B	2007 Q1	3/12/2007	0.113	ND
Fab 11X-B	2007 Q2	4/24/2007	0.196	ND
Fab 11X-B	2007 Q2	5/1/2007	0.153	ND
Fab 11X-B	2007 Q2	5/7/2007	0.165	ND
Fab 11X-B	2007 Q3	7/31/2007	0.205	0.023
Fab 11X-B	2007 Q3	8/7/2007	0.22	ND
Fab 11X-B	2007 Q3	8/13/2007	0.21	0.011
Fab 11X-B	2007 Q4	11/2/2007	0.298	0.009
Fab 11X-B	2007 Q4	11/9/2007	0.322	0.011
Fab 11X-B	2007 Q4	11/16/2007	0.341	ND
Fab 11X-F	2007 Q1	3/15/2007	0.497	0.124
Fab 11X-F	2007 Q1	3/22/2007	0.419	ND
Fab 11X-F	2007 Q1	3/28/2007	0.533	ND
Fab 11X-F	2007 Q2	5/22/2007	0.32	ND
Fab 11X-F	2007 Q2	5/29/2007	0.28	ND
Fab 11X-F	2007 Q2	6/4/2007	0.249	ND
Fab 11X-F	2007 Q3	7/10/2007	0.291	0.073
Fab 11X-F	2007 Q3	7/17/2007	0.317	0.052
Fab 11X-F	2007 Q3	7/23/2007	0.347	0.049
Fab 11X-F	2007 Q4	10/19/2007	0.619	0.068
Fab 11X-F	2007 Q4	10/26/2007	0.731	0.075
Fab 11X-F	2007 Q4	11/1/2007	0.53	ND
Fab 11X-B	2008 Q1	3/7/2008	0.402	0.047
Fab 11X-B	2008 Q1	3/14/2008	0.369	ND
Fab 11X-B	2008 Q1	3/20/2008	0.398	0.029
Fab 11X-B	2008 Q2	5/9/2008	0.397	0.012
Fab 11X-B	2008 Q2	5/16/2008	0.346	0.012
Fab 11X-B	2008 Q2	5/22/2008	0.415	ND
Fab 11X-B	2008 Q3	9/3/2008	0.306	0.024
Fab 11X-B	2008 Q3	9/10/2008	0.305	0.041
Fab 11X-B	2008 Q3	9/16/2008	0.321	0.046
Fab 11X-B	2008 Q4	11/11/2008	0.389	0.053
Fab 11X-B	2008 Q4	11/18/2008	0.395	0.019
Fab 11X-B	2008 Q4	11/24/2008	0.405	0.029
Fab 11X-F	2008 Q1	2/21/2008	0.365	0.022
Fab 11X-F	2008 Q1	2/28/2008	0.482	0.036
Fab 11X-F	2008 Q1	3/5/2008	0.515	0.029
Fab 11X-F	2008 Q2	6/3/2008	0.366	0.018
Fab 11X-F	2008 Q2	6/10/2008	0.288	0.013
Fab 11X-F	2008 Q2	6/16/2008	0.344	0.046
Fab 11X-F	2008 Q3	8/15/2008	0.212	0.101
Fab 11X-F	2008 Q3	8/22/2008	0.434	0.181
Fab 11X-F	2008 Q3	8/29/2008	0.129	0.022
Fab 11X-F	2008 Q4	12/4/2008	0.13	0.042
Fab 11X-F	2008 Q4	12/11/2008	0.178	0.046
Fab 11X-F	2008 Q4	12/17/2008	0.162	0.056



Enclosure 1: RTO Emission Factor Explanation

Firing Rate (MMBtu/hr)	Rated Capacity	Jan'07	Feb'07	Mar'07	Apr'07	May'07	Jun'07	Jul'07	Aug'07	Sep'07	Oct'07	Nov'07	Dec'07
11s.8.2 (Fab 11x Bridge)	2.5	1.43	1.46	1.43	1.46	1.49	1.53	1.56	1.53	1.49	1.50	1.49	1.48
10s.8.1a (Fab 11x Fab)	2.5	1.55	1.50	1.47	1.44	1.45	1.51	1.54	1.49	1.45	1.42	1.39	1.37

Firing Rate (MMBtu/hr)	Rated Capacity	Jan'08	Feb'08	Mar'08	Apr'08	May'08	Jun'08	Jul'08	Aug'08	Sep'08	Oct'08	Nov'08	Dec'08
11s.8.2 (Fab 11x Bridge)	2.5	1.41	1.45	1.46	1.47	1.48	1.50	1.32	1.47	1.43	0.93	1.45	1.44
10s.8.1a (Fab 11x Fab)	2.5	1.35	1.40	1.41	1.43	1.46	1.51	1.50	1.29	1.52	1.67	1.73	1.73



## Enclosure 2

# HAPs and VOC Emission Factor Explanation

## **Emission Factor Development**

The following approach to emission factor development at the site is the same approach used in the October 1999 minor source permit application.

Semiconductor manufacturing is essentially a series of batch operations. Typically, a process step will be performed on a batch of wafers, the processing chamber will be emptied, and the next batch will be inserted to start the process over. A batch size at Intel can range from 1 - 25 wafers. For the selected process steps, emissions were tested over the course of several batches. Each time a batch is run, the process recipe is followed precisely, so the chemical inputs are known. During the course of the testing, emissions were measured directly from the individual tool each time a batch of wafers was run (see Attachment 1 for analytical procedure). This was typically repeated 5 - 10 times. The airflow in the tool exhaust was also measured prior to the start of the testing. The total mass of emissions (lbs.) was then calculated for the process step by determining the average concentration in the exhaust of the pollutant of concern, and multiplying by the air flow rate. Due to the very consistent nature of the process recipes, a very high degree of repeatability was observed among the multiple tests of an individual step.

The measured emissions were then converted into a simple emission factor as follows:

Emission factor = (measured output of chemical of concern)/(process recipe input of producing chemical).

For example, one process step uses  $2.5 \times 10^{-3}$  lbs. of chlorine gas for every wafer produced. The emissions testing on this step produced an average result of  $8.3 \times 10^{-5}$  lbs. hydrochloric acid (HCl) per wafer, and  $1.8 \times 10^{-3}$  lbs. chlorine (Cl<sub>2</sub>) per wafer. The emissions factors developed from these tests for this process step were:

$$\begin{aligned}\text{EF Cl}_2 \text{ to HCl} &= (8.3 \times 10^{-5}) / (2.5 \times 10^{-3}) = .03 \\ \text{EF Cl}_2 \text{ to Cl}_2 &= (1.8 \times 10^{-3}) / (2.5 \times 10^{-3}) = .72\end{aligned}$$

In other words, on this process step every 100 lbs. of chlorine used will generate 3 lbs. of HCl emissions and 72 lbs. of Cl<sub>2</sub> emissions.

The following are other example calculations for emission factors:

### Example 1.

Ethyl lactate is used on lithography tracks. The amount of ethyl lactate used per wafer is rigorously defined for a given process and does not vary from wafer to wafer. Intel performed emissions testing on various manufacturing steps of the lithography track tools. This was performed with real time FTIR measurements during actual wafer manufacturing. On a given process step, anywhere from 5 to 25 wafers would be tested, over a total time of 5 – 60 minutes.

Six different lithography track steps were tested. The results of these tests and the way the data was turned into an overall ethyl lactate (EL) emission factor are shown below.

## Enclosure 2: HAPs and VOC Emission Factor Explanation

	<b>EL Use lbs./wafer</b>	<b>EL Emissions lbs./wafer</b>
Step 1	.00091	0.00023
Step 2	.00728	0.00160
Step 3	.00091	0.00018
Step 4	.00091	0.00018
Step 5	<u>.00182</u>	<u>0.00036</u>
<i>Total</i>	<i>.01183</i>	<i>0.00255</i>

Overall EF = total emissions/total use = .00255/.01183 = 0.22

All ethyl lactate emissions from this process are vented to the control devices. An efficiency of 97% was assumed, based on current tests results of those devices(see Attachment 3 for details).

Emission Factor x (1 - % removal efficiency) = post abated emission factor

$$0.22 \times (1-0.97) = 0.0066 \text{ lbs EL emissions/lb EL use}$$

### Example 2.

Methanol is used in two different locations in the fab – metal etch and lithography. In the metal etch process, emissions were found to be zero because the autoignition temperature of methanol is listed as 470°F, and the operating temperature of the metal etch chamber is higher than this. The methanol used in these operations come in two different types of containers with two different Intel part numbers. This makes it easy to determine which portion of the methanol is used in metal etch vs. lithography.

In lithography, methanol is used on only one manufacturing step. This step was tested four times, with each test consisting of 5 wafers through. The results of the four tests were as follows

<b><u>Run #</u></b>	<b><u>Methanol Use (lb/wafer)</u></b>	<b><u>Methanol Emission (lb/wafer)</u></b>
1	0.0162	5.1 x 10 <sup>-3</sup>
2	0.0162	3.9 x 10 <sup>-3</sup>
3	0.0162	6.2 x 10 <sup>-3</sup>
4	0.0162	4.6 x 10 <sup>-3</sup>

Average Emission Factor = .30

All methanol emissions from this process are vented to the control devices. An efficiency of 96% was assumed, based on current tests results (see Attachment 3 for details).

Emission Factor x (1 - % removal efficiency) = post abated emission factor

$$0.3 \times (1-0.96) = 0.012 \text{ lbs Methanol emissions/lb Methanol use}$$

## Enclosure 2: HAPs and VOC Emission Factor Explanation

### Example 3.

Since most HAPs chemicals are used on more than one process step, overall process emission factors were developed for all HAP producing chemicals used in the process. The overall emission factor defines the total amount of a given chemical on a given process which will be converted to a HAP. For example, if a given process step uses sulfur hexafluoride (SF<sub>6</sub>) in three places, the overall emission factor will be determined by adding the results of all three of those process steps as shown below

Process Step	Chemical pathway	Chemical Use, lbs./wafer	Emissions, lbs./wafer
Etch 1	SF <sub>6</sub> to HF	$2 \times 10^{-3}$	$2 \times 10^{-5}$
Etch 2	SF <sub>6</sub> to HF	$5 \times 10^{-3}$	$1 \times 10^{-5}$
Etch 3	SF <sub>6</sub> to HF	$3.5 \times 10^{-3}$	$1.05 \times 10^{-5}$
Total		$1.05 \times 10^{-2}$	$4.05 \times 10^{-5}$

$$\text{Overall EF} = (\text{total emissions/total use}) = 4.05 \times 10^{-5} / 1.05 \times 10^{-2} = 0.004$$

All hydrofluoric acid (HF) emissions from this process are vented to the control devices. An efficiency of 70% was assumed, based on current tests results of those devices (see Attachment 2 for details).

$$\text{Emission Factor} \times (1 - \% \text{ removal efficiency}) = \text{post abated emission factor}$$

$$0.004 \times (1 - 0.70) = 0.0012 \text{ lbs HF emissions/lb SF}_6 \text{ use}$$

### **Removal Efficiencies**

The efficiency of the abatement system is taken into account to calculate the overall emission factor after abatement using the following equation:

$$\text{EF (after abatement)} = \text{EF (prior to abatement)} \times (100\% - \% \text{ abatement efficiency})$$

The abatement efficiencies listed below were used to derive the emission factors after abatement and were based on stack testing. The abatement efficiencies were not changed for this submittal.

Methanol = 96%

Hydrofluoric Acid = 70%

Hydrochloric Acid = 69%

Chlorine = 53%

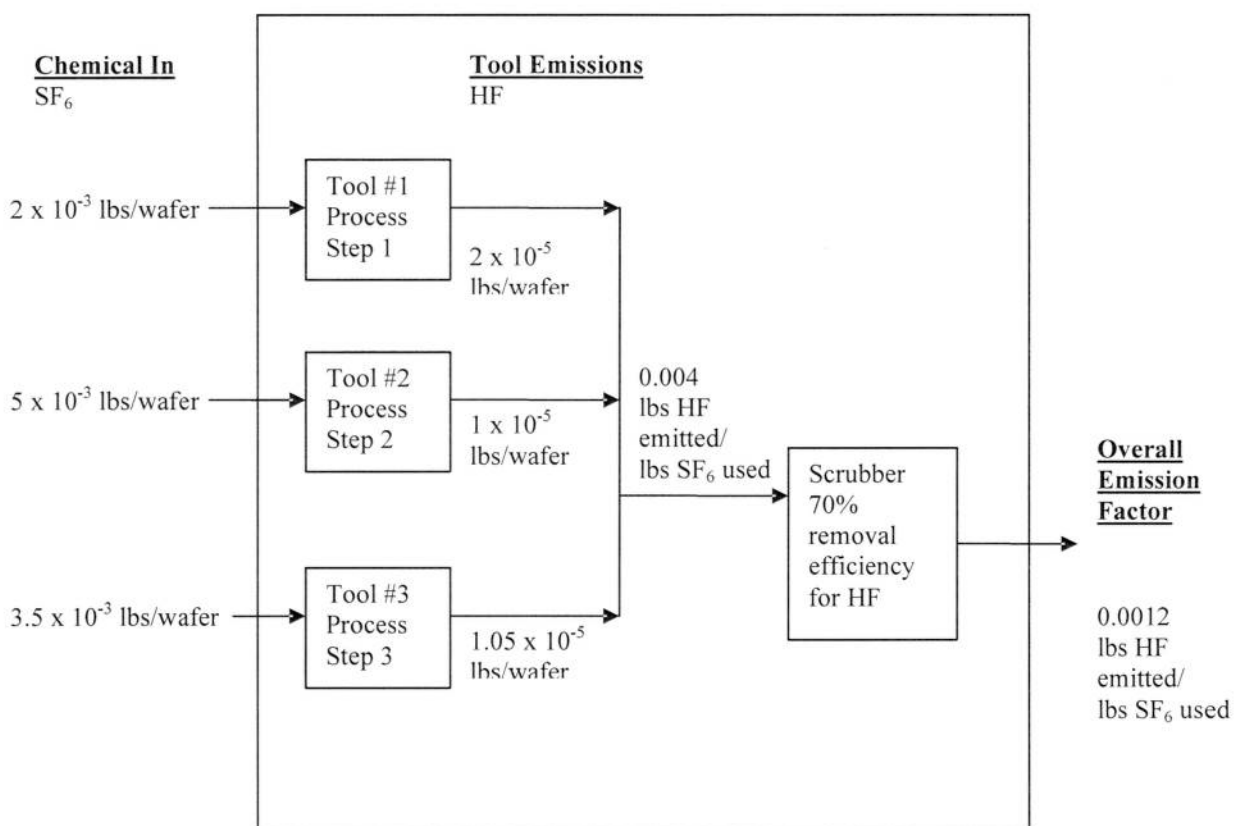
VOCs routed to thermal oxidizer (other than Methanol) = 97%

All other chemicals were assumed to have 0% abatement efficiency.

The following diagram depicts how the emission factor is calculated for Example 3 above:



## Enclosure 2: HAPs and VOC Emission Factor Explanation



## Enclosure 2: HAPs and VOC Emission Factor Explanation

Table 3 (page 1 of 1)  
Emission Factors for HAPs<sup>1</sup>

Pollutant	Chemical or Precursor	Emission Factor			
		G	H	I	J
HF					
SF6 to HF	Sulfur Hexafluoride (SF6)	0.0047	-	0.0009	-
CF4 to HF	Carbon Tetrafluoride (CF4)	0.0025	-	0.0037	-
CHF3 to HF	Trifluoromethane (CHF3)	0.0337	-	0.0114	-
NF3 to HF	Nitrogen Trifluoride (NF3)	0.0046	0.0047	0.0057	0.0046
WF6 to HF	Tungsten Hexafluoride (WF6)	0.0341	-	0.0341	-
C4F8 to HF	Octafluorocyclobutane (C4F8)	0.0255	-	0.0294	-
CH2F2 to HF	Difluoromethane (CH2F2)	0.0362	-	0.0248	-
C5F8 to HF	Octafluorocyclopentene (C5F8)	0.0343	-	0.0334	-
BF3 to HF	Boron Trifluoride (BF3)	0.0600	-	0.0600	-
HF to HF	Hydrogen Fluoride (HF)	-	0.1364	-	-
C4F6 to HF	Hexafluoro-1,3-butadiene (C4F6)	0.0508	-	0.0100	-
HCl					
Cl2 to HCl	Chlorine (Cl2)	0.0835	-	0.0500	-
DCE to HCl	Trans 1,2-Dichloroethene (DCE)	0.1004	-	0.1004	-
DCS to HCl	Dichlorosilane (DCS)	0.0002	-	0.0002	-
HCl	Hydrogen Chloride (HCl)	0.0017	-	0.0932	-
HCl	Hydrogen Chloride (HCl) VMB	0.0961	-	0.0961	-
HCl	Hydrogen Chloride (HCl) RFC	0.3100	-	0.3100	-
11AVD to HCl	11AVD	0.1021	-	0.1021	
Cascade to HCl	Cascade	0.1021	-	0.1021	
ACME to HCl	ACME	0.0024	-	0.1550	
Cl2					
Cl2	Chlorine (Cl2)	0.2921	-	0.4372	-
DCE to Cl2	Trans 1,2-Dichloroethene (DCE)	0.0940	-	0.0940	-
DCS to Cl2	Dichlorosilane (DCS)	0.0000	0.0000	0.0000	0.0000
Others					
Cl2 to CCl4	Chlorine (Cl2)	0.0058	-	0.00001	-
Methanol	Methanol (abated)	0.0181	-	0.0181	-
Methanol (gensolve)	Methanol (abated)	-	0.0004	-	0.000004
AsH3	Arsine (AsH3)	0.0050	-	0.0050	-
PH3	Phosphine (PH3)	0.0050	-	0.0893	-
Diethylene Glycol Monomethyl Ether	Diethylene Glycol Monomethyl Ether	0.0000	-	0.0000	
Bromoform*	Sodium Bromide – CUB	0.0605			
Bromoform*	Sodium Bromide – NEC	0.0096			
LCP Oxide Etch to NH3	LCP Oxide Etch	0.0008		0.0008	
LCP Oxide Etch to NOx	LCP Oxide Etch	0.0005		0.0005	
Any Other HAP Listed In Appendix X <sup>2</sup>		1			

Notes: 1 Emission factors take into account control efficiencies, where applicable. Chemicals having emission factors equal to zero (0.0) are either completely consumed in the process or are solid sources with negligible vapor pressures. Intel may revise the emission factors following Condition 1.G. EFs for processes no longer in use have been removed from this table.

2 This category does not include those HAPs chemicals for which Intel uses the sink evaporation equation specified in Condition 5.D.iv to calculate emissions.

\*Site EF, not associated with a single process

"- "chemical not used on this technology

Enclosure 2: HAPs and VOC Emission Factor Explanation

Table Z (page 1 of 1)  
Emission Factors for VOCs

Pollutant	Emission Factors			
	G	H	I	J
5-Chloro-2-methyl-4-isothiazolin 3-one	0.0000	-	0.0000	-
Carbon Monoxide*	1.0000	1.0000	0.2139	-
1,2-Cyclohexylenedinitrilotetraacetic acid	0.0000	-	0.0000	-
Cyclohexanone	0.0051	-	0.0029	-
Diethyl Ketone	0.0026	-	0.0026	-
Diethylene Glycol Monomethyl Ether	0.0000	-	0.0000	-
Dimethyldimethoxysilane (DMDMOS)	0.0153	-	0.0933	-
Ethanol	0.0150	-	0.0156	-
Ethanol (Polyimide)	0.0133	-	0.0133	-
Ethyl Lactate	0.0047	0.0135	0.0055	0.0135
Gamma-Butyrolactone	0.0071	-	0.0058	-
Hexafluoro-1,3-butadiene (C4F6)	0.1226	-	0.3263	-
Hexamethyldisilazane (HMDS)	0.0163	-	0.0171	-
Isoamyl Ether	-	-	0.0058	-
Isopropyl Alcohol (abated)	0.0062	0.0125	0.0057	0.0161
Isopropyl Alcohol (bottled)	0.9020	-	0.9020	-
Isopropyl Alcohol (SLAM)	0.0153	-	0.0167	-
Malonic Acid	0.0000	-	0.0000	-
Methanol (gensolve)	-	0.0004	-	0.000004
Methyl Isobutyl Carbinol	-	-	0.0058	-
2-Methyl-4-isothiazolin 3-one	0.0000	-	0.0000	-
Methyl n-amyl ketone (2-Heptanone)	-	0.0135	-	0.0135
1-Methyl-2-pyrrolidinone (NMP)	0.0005	-	0.0005	-
1-Methyl-2-pyrrolidinone - (from GenSolve)	-	0.0009	-	0.000004
n-Butanol	0.0049	-	0.0049	-
Octafluorocyclopentene (C5F8)	0.1472	-	0.1588	-
PDMAT	0.0092	-	0.0092	-
Propylene Glycol Monomethyl Ether (PGME)	0.0058	0.0105	0.0167	0.0099
Propylene Glycol Monomethyl Ether Acetate (PGMEA)	0.0059	-	0.3513	-
Propene (C3H6)	-	-	0.1883	-
Tetrakis(dimethylamino)titanium (TDMAT) to Diethyl Amine	0.0300	-	0.0300	-
Tetramethylsilane	0.0100	-	0.0100	-
Trans 1,2-Dichloroethene (DCE)	0.0000	-	0.0000	-
Any Other VOC chemicals <sup>2</sup>	1			

Notes:

<sup>1</sup> Emission factors take into account control efficiencies, where applicable. Chemicals having emission factors equal to zero (0.0) are either completely consumed in the process or are solid sources with negligible vapor pressures. Intel may revise the emission factors following Condition 1.G. EFs for processes no longer in use have been removed from this table.

<sup>2</sup> This category does not include those VOC chemicals for which Intel will use the sink evaporation equation specified in Condition 4.D.iv.a to calculate emissions.

\* Carbon Monoxide is not a VOC but will be reported with site CO emissions

"- "chemical not used on this technology

## Emission Factor Weighting

At Intel, multiple manufacturing processes are being run at any given time. Each manufacturing process may use chemicals in different quantities and have a different emission factor. In order to more accurately calculate emissions, emission factors for each individual manufacturing process are being proposed for inclusion in the permit and are included in Tables 3 and Z above. To calculate emissions each quarter, the actual production level will be used to allocate the chemical use for the site to the various processes. This approach to weighting is the same approach that was submitted and explained in the August 2002 emission factor update. The weighted average is calculated as follows:

$$WA_A (\%) = \frac{CU_A \times WS_A}{(CU_A \times WS_A + CU_B \times WS_B + CU_C \times WS_C + \dots)}$$

where:

$WA_A$  = Weighted average for Process A (%)  
 $CU_A$  = Chemical Usage for Process A (pounds/wafer processed)  
 $WS_A$  = Actual production level for Process A (wafers processed/quarter)  
 $CU_B$  = Chemical Usage for Process B (pounds/wafer processed)  
 $WS_B$  = Actual production level for Process B (wafers processed/quarter)

The weighted average (%) for process A is the chemical usage for process A multiplied by the actual production level for process A divided by the sum of the chemical used for individual processes multiplied by the actual production level for the individual processes.

Emissions for a particular chemical would then be calculated as follows:

$$\text{Site Emissions}_1 = WA_A \times EF_A \times ACU_1 + WA_B \times EF_B \times ACU_1 + WA_C \times EF_C \times ACU_1 + \dots$$

where:

$\text{Site Emissions}_1$  = Emissions for Chemical 1 (i.e. chlorine, methanol)  
 $WA_A$  = Weighted average for Process A (%)  
 $EF_A$  = Emission Factor for Process A  
 $ACU_1$  = Actual chemical use for Chemical 1 (i.e. chlorine, methanol)  
 $WA_B$  = Weighted average for Process B (%)  
 $EF_B$  = Emission Factor for Process B

The site emissions for chemical 1 (i.e. chlorine) is the total of the weighted average (%) for an individual process multiplied by the emission factor for the individual process multiplied by the actual chemical use for chemical 1.

## Enclosure 2: HAPs and VOC Emission Factor Explanation

The following table and equations provide an example calculation for site emissions of HF from SF<sub>6</sub>:

	Process A	Process B	Process C	Process D	Site
Production (wafers processed/quarter)	5000	750	1000	2000	
Chemical Usage for Process (lbs SF <sub>6</sub> /wafer processed)	2.01E-02	1.37E-02	1.05E-02	5.24E-03	
Weighted Average for Process (%)	76%	8%	8%	8%	
Emission Factor for Process	0.0074	0.024	0.0079	0.0051	
Actual Chemical Usage SF <sub>6</sub> (lbs)					140
Emissions HF (lbs)					6.2

The following calculation shows the how the weighted average for Process A is determined:

$$WA_A = \frac{5000 \times 2.01E-02}{5000 \times 2.01E-02 + 750 \times 1.37E-02 + 1000 \times 1.05E-02 + 2000 \times 5.24E-03} = 76\%$$

The following calculation shows how the site emissions for HF from SF<sub>6</sub> would be determined:

$$SiteEmissions_{HF} = 0.76 \times 0.0074 \times 140 + 0.08 \times 0.024 \times 140 + 0.08 \times 0.0079 \times 140 + 0.08 \times 0.0051 \times 140 = 6.2 \text{ lbs HF}$$

## **Attachment 1**

### **Analytical Method used for Tool Testing**

The following is an excerpt outlining the analytical method used for tool testing. This document is updated frequently and is subject to change.

<http://www.sematech.org/docubase/document/4197axfr.pdf>